JPRS 71649

9 August 1978

2000424 039

TRANSLATIONS ON EASTERN EUROPE

SCIENTIFIC AFFAIRS

No. 596

EAST EUROPE

U. S. JOINT PUBLICATIONS RESEARCH SERVICE

36

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BIBLIOGRAPHIC DATA SHEET	1. Report No. JPRS 71649	2.	3. Recipient's Accession No.
4. Title and Subtitle TRANSLATIONS ON EASTERN EUROPE - SCIENTIFIC AFFAIRS, No. 596			5. Report Date 9 August 1978
			6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Joint Publications Research Service 1000 North Glebe Road Arlington, Virginia 22201			10. Project/Task/Work Unit No.
			11. Contract/Grant No.
12. Sponsoring Organization Name and Address As above			13. Type of Report & Period Covered
			14.

15. Supplementary Notes

16. Abstracts

The serial report contains articles concerning the development of and progress in the various theoretical and applied scientific disciplines and technical fields; and the administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences.

17. Key Words and Document Analysis. 17a. Descriptors

X International Affairs	Scientific Societies
___ Albania	Research Management
X Bulgaria	Organizations
___ Czechoslovakia	Research
___ East Germany	
X Hungary	
X Poland	
X Romania	
___ Yugoslavia	

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group 5B

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Unlimited Availability Sold by NTIS Springfield, Virginia 22151	UNCLASSIFIED	36
	20. Security Class (This Page) UNCLASSIFIED	22. Price PCA03

FORM NTIS-35 (REV. 3-72)

USCOMM-DC 14952-P72

JPRS 71649

9 August 1978

TRANSLATIONS ON EASTERN EUROPE

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CONTENTS PAGE

 [III - EE - 65]

REGULATION ON TRANSPORTATION OF USED NUCLEAR FUEL TO CEMA COUNTRIES

Sofia DURZHAVEN VESTNIK in Bulgarian 20 Jun 78 pp 570-574

[Rules governing the safe transportation of used nuclear fuel from atomic power plants of the CEMA countries as approved by the 83d Session of the CEMA Executive Committee, Vol V of the Protocol of 23 November 1977; approved by the Bureau of the Council of Ministers by Decision No 223 of 14 December 1977; in force as of 1 July 1978]

[Text] Part I. Transportation by Rail

1. General Provisions

1.1. These rules determine the basic provisions in effect in the preparation, organization and transport of used nuclear fuel by rail between the CEMA countries.

1.2. The transporting of used nuclear fuel in the form of fuel assemblies (termed below FA) is to be carried out in accord with these rules according to the technical conditions agreed upon by the CEMA countries for the FA (used) from atomic power plants (AETs) with reactors of the corresponding type (hereafter, the FA technical conditions), and also in accord with the current international documents in this area as approved by the member nations to these rules.

1.3. For ensuring aviation and nuclear safety in the preparation, organization and transporting of the FA, the Rules for Safe Transporting of Radioactive Substances are to be applied (the revised edition of 1973 of the safety standards of the International Atomic Energy Agency (IAEA), Safety Series No 6), hereafter called the IAEA Rules for the Safe Transporting of Radioactive Substances.

1.4. In transporting the FA, the nations participating in these rules must take into account the dangerous properties of the goods such as the possibility of the occurrence of a critical state, high radioactivity, toxicity, explosiveness, corrosiveness, and spontaneous ignition, and in line with this take the necessary measures to prevent the occurrence of dangerous situations.

1.5. The nation on whose territory the AETs is located and the nation on whose territory is located the reprocessing plant are to observe the requirements of the Nuclear Weapons Nonproliferation Treaty and the requirements of the IAEA in transporting nuclear materials from one nation to another.

1.6. To the degree that these rules do not envisage other arrangements, in transporting the FA, the Agreement on International Rail Freight Transport (SMGS) and the Regulation Governing the Use of Railway Cars in International Passenger and Rail Freight Traffic (PPV) which are recognized by the nations participating in these rules are to remain in force.

1.7. In these rules:

1.7.1. Transporting means the transporting of FA and any other operation related to the transporting, including loading, unloading and protection during transport;

1.7.2. The used FA having insignificant damage to the housing of the fuel element [FE], means an assembly having microcracks in the FE casing through which gases escape during its work in the reactor;

1.7.3. A used assembly having significant damage to the casing of the FE means an assembly having cracks of other destruction to the FE housing through which the nuclear fuel is flushed out during its operation in the reactor, as well as a destroyed, cut or melted assembly;

1.7.4. A radiation accident means an accident, including a nuclear one, which may cause the release of radioactive substances in the environment in quantities exceeding the value of the packaging tolerances indicated in the IAEA Rules for the Safe Transporting of Radioactive Substances (Point 230b) or exceeding the level of the power of the equivalent radiation dose designated in Point 3.11 of these rules;

1.7.5. A railroad accident means an accident which can cause the halting of the special train due to a technical malfunction of the rail transport or the rail line but unrelated to the damage to the containers carrying the used nuclear fuel;

1.7.6. The safety car means each car included in the special train for providing the safety of the freight;

1.7.7. The competent bodies mean the national bodies designated in the appendix to these rules and empowered or recognized by the corresponding nations as such for all purposes related to these rules.

2. Technical Requirements Made in Transporting Used Nuclear Fuel

2.1. The FA which are to be sent to the reprocessing plants must meet the technical requirements for the FA approved by the CEMA members.

2.2. The nation on whose territory the AETs is located is to provide the following:

2.2.1. The performing of all operations involving the FA in strict accord with the plans for the transport-production facilities of the AETs and the working operational instructions which regulate the compulsory observance of the requirements of the FA technical condition;

2.2.2. Control over the technical and physical state of all the FA sequentially through all stages of work from the moment of receiving the FA from the nation on whose territory the producing plant is located, up to the dispatching of them to the nation on whose territory the reprocessing plant is located.

2.3. FA before dispatch to the reprocessing plant are to be held in the FA holding pools of the AETs for at least 3 years from the day of shutting down the water-cooled power reactor (WCPR) for reloading and from the moment of removing the fuel for other types of reactors. The time for holding the FA may be reduced to 2 years for the AETs the plans of which envisage a capacity of the holding tanks designed for 2 years.

2.4. The designs of the containers and the container sets in which the FA are transported to the nation on whose territory the reprocessing plant is located must meet the safe transporting requirements, they must be qualified for mechanical and thermal stability, for airtightness and for radiation and nuclear safety, and must be approved by the competent bodies of the nations participating in the transporting in accord with the IAEA Rules for the Safe Transporting of Radioactive Substances, Section II (Points 228-224) and Sections VI and VIII.

2.5. The transporting container sets in which the FA will be transported to the nation on whose territory the reprocessing plant is located, depending upon the technical state of the assemblies after their use in the reactor, must contain:

2.5.1. Transport containers and transport packaging in the form of cases (metal b.r. [expansion unknown]) for transporting the FA which do not have any damage to the casing of the fuel elements;

2.5.2. Transport containers and transport packaging in the form of cases (metal b.r.) and reusable airtight vessels (cans) in transporting FA having insignificant damage to the FE casings;

2.5.3. Transport containers and transport packaging in the form of cases (metal b.r.) and airtight vessels (cans) for single use in transporting the FA which have significant damage to the FE casings.

3. Transporting Conditions

3.1. The FA are delivered to the nation on whose territory the reprocessing plant is located by special trains in special container freight cars as a full load (carloading) in through nontransloaded rail traffic.

3.2. The special train must be made up of the container cars, the accompanying cars and two safety cars.

The container cars and the accompanying cars designed for the transporting of the FA from series reactors are the property of the nation on whose territory the reprocessing plant is located. The quantitative composition of the cars in the special train is determined by the technical conditions for the FA.

The safety cars are provided by each railroad participating in the transport during the passage of the special train across the territory of its state. In the event that by mutual agreement the safety cars will pass over the territories of two or more states, they must meet the technical conditions of the PPV.

The questions related to the safety cars and their place in the consist are determined by the internal rules of the railroads participating in the shipping of the used nuclear fuel.

3.3. The container cars and the accompanying cars must meet the specifications and technical conditions of the plants producing these cars and also meet the technical requirements according to the PPV current for cars with a gauge of 1,435 mm and 1,520 mm.

The handling of the designated cars in the railroads of the nations participating in these rules is carried out according to the conditions stemming from Point 2, §14 of the PPV and in effect for railway cars not belonging to the railroads of the nation.

The transport containers and the transport packaging (cases and cans) must conform to the specifications and technical conditions of the producer plants, and have markings in accord with the requirements of the technical conditions for the FA and the IAEA Rules for the Safe Transporting of Radioactive Substances, Section VIII (Points 822 and 823). The designated equipment must be in a proper working state.

3.4. The nation which owns the container cars and the accompanying cars provides the proper technical order of the special equipment in observing the rules for its technical operation.

3.5. Prior to the dispatch of the FA to the reprocessing plant, permission is drawn up in accord with the IAEA Rules for the Safe Transporting of Radioactive Substances, Section VIII.

3.6. The dispatching of the special train with the FA and also the empty transport containers must be first approved among the competent bodies of the nations participating in the transporting of the FA and carried out according to the procedure stipulated in the regulations of Article 5 of the SMGS.

3.7. Prior to each shipment of FA, testing of the containers must be carried out as well as other measures in accord with the IAEA Rules for the Safe Transporting of Radioactive Substances, Section VII (Points 738 and 739), and in addition the technical state of the cars must be inspected according to the program agreed upon by the nations participating in these rules.

3.8. The loading of the FA in the transport packing and the transport packing into the transport containers and the transport containers onto the container car is carried out by the personnel and equipment of the sender following procedures stipulated in the plans of the transport-production facilities of the AETs and the requirements of the FA technical conditions.

In the event that on the territory of the AETs there is no railroad line, the nation on whose territory the AETs is located on its own territory provides for the transloading of the transport containers from the rail transport to any other (motor or water) and the delivery of them to the loading installation of the AETs and back.

3.9. The sender, prior to loading the FA into the transport packing and into the transport containers is obliged to establish:

3.9.1. The conformity of transport packing to the technical state of the FA and to the type of packing according to the FA technical conditions;

3.9.2. The absence of leaks, rust and foreign matter in the transport packing and containers.

3.10. Prior to the departure of the special train with the FA from the AETs and also in the departure of an empty train from the reprocessing plant, dosimetric monitoring is carried out of these trains for the degree of radiation and superficial contamination.

3.11. The power of the equivalent radiation dose at any point on the external surface of the container car and also the external surface of the packing with the FA must not exceed 200 mber/hr, and at any point 2 meters away from the vertical plane formed by the outside side surfaces of the container car, 10 mber/hr.

3.12. The unfixed radioactive contamination at any point on the inner surface of the container car, on the inner surface of the packing set for the FA and the equipment which is located inside the loaded or empty container car upon departure must not exceed:

for beta or gamma emitters	10^{-4} microcuries per cm^2;
for alpha emitters	10^{-5} microcuries per cm^2.

The unfixed radioactive contamination of the external surface of the container car must be as low as is practically possible, but must not exceed:

for beta or gamma emitters	10^{-5} microcuries per cm^2;
for alpha emitters	10^{-6} microcuries per cm^2.

The designated maximum levels of radioactive contamination also apply to the empty transport containers and container cars which are empty of FA.

The above values are acceptable in the instance of averaging at any part of the surface with an area of 300 cm^2.

3.13. The accompanying and safety cars which are part of the consist of the special train must not be radioactively contaminated.

3.14. The transport containers loaded with FA must be sealed by the representatives of the AETs and by representatives of the nation on whose territory the reprocessing plant is located, and when necessary, by representatives of the IAEA.

3.15. Before the departure of a special train with FA from the AETs and also in the departure of an empty train from the reprocessing plant, the shipping documents are drawn up in accord with the SMGS.

3.16. The representative of the nation on whose territory the reprocessing plant is located, prior to the loading of the FA into the special train, submits the following documents to the representatives of the nation on whose territory the AETs is located:

3.16.1. A copy of the documents for certification of the packing sets;

3.16.2. Protocols of the dosimetric monitoring of the special train.

3.17. The acceptance of the FA of the AETs is drawn up in a protocol to which are appended:

3.17.1. The specifications of the FA, the cases, the transport containers and the diagrams for loading the casings and filled out in accord with the requirements of the FA technical conditions;

3.17.2. Protocols of the dosimetric monitoring of the special train;

3.17.3. Protocols of the sealing of the containers.

3.18. At the point where the loaded special train is turned over to the nation on whose territory the reprocessing plant is located as well as at

the point where the empty train is turned over to the nation on whose territory the AETs is located, the representatives of these nations draw up a protocol for the turning over of the means of transport and to which they append:

3.18.1. Protocols of the dosimetric monitoring drawn up at the AETs (at the reprocessing plant) and the place where the special train is turned over;

3.18.2. Protocols for the sealing of the containers;

3.18.3. Protocols from a check on the completeness of the equipment of the special train according to the data of the inventory.

In turning over a loaded special train to a nation on whose territory the reprocessing plant is located, to the protocol for turning over the means of transport they also append the specifications of the FA, the packing, the transport containers and the diagrams for the filling of the packing and filled out by the AETs in accord with the requirements of the FA technical conditions.

3.19. To the representatives of the nations across whose territory the freight is to be transited, the following are supplied:

3.19.1. A copy of the protocol of the dosimetric monitoring of the special train;

3.19.2. A copy of the inventory of the transported FA.

3.20. The transporting of the FA is carried out under the constant control of the competent bodies of the nations over whose territory the shipment is made.

4. Procedure for Notification of Shipments

4.1. The competent bodies of the nation dispatching the FA, no later than 15 days prior to the departure of the special loaded or empty train, notify by telegraph (telex) the appropriate competent bodies of the recipient nation as well as the nations across which a transit shipment is to be made of the departure of the freight, and indicate the border points through which the special train will pass, as well as the time of its arrival at the border stations.

4.2. The competent bodies of the nation sending the FA inform the competent bodies of the nations across whose territory the freight is to be transited as well as the recipient nation of the actual date of dispatch of the freight and the expected arrival of the special train at the border stations.

4.3. In the event of a disruption of the traffic schedule of the special train, a representative from the competent body of the nation on whose territory the disruption has occurred immediately provides information on the change in the arrival time of the train at the border stations.

4.4. The competent bodies of the sending nation can dispatch a loaded special train after the competent bodies of the nation over whose territory the shipment is to be transited and the recipient nation have given their agreement to this.

5. Escort and Security

5.1. The escort and security of the special train are carried out by the technical personnel for servicing the special equipment of the special train, the technical personnel of the railroads (the train brigade) and security.

5.2. The technical personnel for serving the special equipment is provided by the nation owning the container car and the accompanying cars, and they accompany the cars during the entire journey. If the container cars and the accompanying cars belong to the nation on whose territory the AETs is located, the service personnel accompany the cars from the AETs to the frontier of the nation on whose territory the reprocessing plant is located, and vice versa.

5.3. The technical personnel from the railroads (train brigade) is provided for the accompanying of a special train consist by the nation over whose territory it is to pass. The quantitative composition and the tasks of the train brigade are determined by the domestic regulations of the railroads in the given nation.

5.4. Security for the special train is provided by the nation over whose territory the train passes.

5.5. The technical personnel which serves the special equipment on the special train is under the jurisdiction of the rules of the railroads in effect in the nation over whose territory the train is passing.

The technical personnel serving the special equipment on the special train is obliged to know and observe the Fire Rules as well as the methods for extinguishing a fire, the measures to eliminate the consequences of an accident, as well as the procedures for providing medical first aid.

6. Customs Procedures

6.1. The contents of the sealed transport containers are not subject to customs inspection.

6.2. The safety of the contents of the transport containers is monitored from the integrity of the attached seals from the models given in the corresponding documents.

7. Organizational and Technical Measures to Prevent Possible Accidents and Eliminate Their Consequences

7.1. In the event of a radiation accident, the competent bodies of the nation on whose territory the reprocessing plant is located, the nation on whose territory the AETs is located, and the nation across which the freight is being transited work out a plan to eliminate the consequences of the radiation accident, each on its own territory.

7.2. In the event of a radiation accident, the leader of the technical service group of the special train immediately informs the chief of the train brigade of this; the chief in turn immediately notifies the competent body of the nation on whose territory the accident has occurred.

7.3. In the event of a railroad accident with the special train due to the technical malfunctioning of the rolling stock of the railroad line, the chief of the train brigade immediately informs the railroad administration of the nation on whose territory the accident has occurred of this.

7.4. For eliminating the consequences of a radiation accident, the nation on whose territory the AETs is located, the nation on whose territory the reprocessing plant is located, and the nation across which the transit shipment is being made organize emergency brigades equipped with the required equipment and instruments.

7.5. The consequences of the emergency are eliminated by the personnel and equipment of the nation on whose territory the accident has occurred. When necessary the competent body of this nation establishes contact with the competent body of the sender nation and/or the recipient nation, and requests the required personnel and equipment from these nations.

7.6. The accompanying personnel of the special train prior to each shipment of the FA undergo appropriate training and are instructed on how to proceed in an emergency situation. The accompanying personnel of the special train is outfitted with individual protective equipment, dosimetric monitoring instruments, first aid equipment and equipment for the primary extinguishing of a fire, as well as a set of equipment for carrying out radiological decontamination of means of transport, as well as a primary personal cleansing set.

7.7. The decision for continuing the journey of the special train after a radiation accident is taken by the competent body of the nation on whose territory the accident has occurred.

7.8. For solving the questions arising in line with a radiation accident, including restitution of damages, the nations participating in the shipment, in accord with these rules, will set up under agreement special bi- or multilateral (including intergovernmental) commissions. These commissions are to be supplied with documents reflecting the actually performed

work to eliminate the consequences of the radiation accident, including diagrams of the radiation situation, and sheets showing data from the radiation surveying of the terrain, means of transport and personnel.

Appendix to Part I

List of Competent Bodies of the Nations for the Transporting of Used Nuclear Fuel

Bulgaria

1. For the questions of nuclear safety in transporting used fuel: Committee for the Peaceful Use of Atomic Energy, 8 Slavyanska, Sofia, tel. 72-02-17.

2. For coordination of transport questions: Ministry of Transport, Sofia.

Hungary

1. For the questions of nuclear safety in the transporting of used fuel: State Atomic Energy Committee, Post Office Box 565, Budapest, 1374; telex 224907 oabh.

2. For coordinating transport questions: Ministry of Transport and Communications, Nepkeztarsasag No 73/75, Budapest, 1940; telex 224342 mavvih.

GDR

1. For the questions of nuclear safety in transporting used fuel: State Administration for Atomic Safety and Defense Against Radiation, 117 Waldowallee, Karlshorst, Berlin, 1157; tel. 50-970, telex 112632 SZSdd.

2. For coordinating transport questions: GDR Ministry of Railroads, Vosstrasse 33, Berlin 108.

Cuba

1. For the questions of nuclear safety in transporting used fuel: National Commission for the Peaceful Use of Atomic Energy, Post Office Box 2169, Havana, tel. 32-9293.

2. For coordinating transport questions: Ministry of Transport, Havana.

Poland

1. For coordinating questions relating to radiation packing: Ministry of Power and Atomic Energy, 2 Misia Street, Warsaw, tel. 217795, telex 814611.

2. For coordinating transport questions: Ministry of Railroads, 4/6 Halubinsky Street, Warsaw 00-613, tel. 244591, telex polfer warszawa 8138.

Romania

1. For the questions of nuclear safety in transporting used fuel: State Committee for Nuclear Energy, Post Office Box 5203, Bucarest-Mugurele.

2. For the question of transporting irradiated fuel: Ministry of Transport and Communications, 38 Dinicu Golescu Boulevard, Bucarest.

USSR

1. For the questions of nuclear safety in transporting used nuclear fuel: State Committee for the Use of Atomic Energy of the USSR, 26 Staromonetnyy Lane, Moscow, Zh-180, 109180.

2. For coordinating transport questions: Ministry of Railways, 2 Novo-basmannaya, Moscow.

CSSR

1. For the questions of nuclear safety in transporting used fuel: Czechoslovak Commission for Atomic Energy, 9 Slezska, Prague 2, 12029.

2. For the questions of transporting irradiated fuel: Federal Ministry of Transport, 33 na Przikope, Prague 1, 11005.

Note. The appropriate nations will immediately notify one another of changes in the names and addresses of the competent bodies through the CEMA Secretariat.

10272
CSO: 2202

PHYSICO-CHEMICAL LABORATORY DEVELOPS BUILDING MATERIALS

Sofia ECONOMIC NEWS OF BULGARIA in English No 6, 1978 p 2

[Text]

The General Laboratory of Physico-Chemical Mechanics at the Bulgarian Academy of Sciences is working on various methods of obtaining materials for use in building and in industry. One of the materials recently obtained at the laboratory is a composition based largely on phosphogypsum – a residue from the production of phosphoric acid whose utilization is still a problem on a world scale. About 100 million tons of this material are obtained in the world every year, our country accounting for some 2 million tons. The method worked out for utilizing this residue will help in solving the important problem of environmental protection.

Another research project dealt with at the Laboratory concerns the production of polymer-concrete pipes. The pipes obtained show high resistance to corrosion and valuable physico-chemical properties, in addition to being appreciably lighter and cheaper than the steel pipes.

The share of phosphogypsum in the new material may vary between 30 and 90 per cent, and this fact creates opportunities for its utilization on a very large scale. Besides that, the new material is obtained without any additional processing of the phosphogypsum. It will be used in making partition panel walls which will in no way be inferior to the most efficient heat- and sound-insulation materials, and will be about 50 per cent cheaper.

The method of making the polymer-concrete pipes has been recognized the status of invention in Bulgaria. It provides for the manufacture of pipes 100 to 700 mm in diameter and with wall thickness of 8 to 30 mm. In their mechanical properties the polymer-concrete pipes manufactured in Bulgaria are superior to similar pipes manufactured abroad. When used in the disposal of tailings and slurry in enterprises of the non-ferrous metallurgy they proved to be up to 7 times more resistant to wear than the special corrosion-proof steel pipes and 4 times more resistant than the PVC pipes. The polymer-concrete piper are between 1.5 and 2.8 times lighter than the steel pipes and 30 per cent cheeper. Their use results in reduced transportation and assembly costs and in longer operational life, hence in obtaining higher economic effect.

CSO: 2020

BRIEF SCIENTIFIC-TECHNICAL NEWS

Sofia ECONOMIC NEWS OF BULGARIA in English No 6, 1978 p 2

[Text]

INNOVATORS at the Ivan Bonov Factory for plastic products in the town of Knezha have devised a highly efficient process for producing fibreglass-plastic vessels. The products related to the new technological process have been manufactured for the first time in Europe. These are the "G-8" and "G-16" containers fitted to machines used in picking grapes, tomatoes and other types of fruit and vegetables. As there is no need of packing, labour productivity has increased many times. The containers manufactured are of 9 and 17 cubic metres capacity. Almost all socialist countries have shown interest in the new product. The first 12 containers have been sent to the Soviet Union and models will soon be sent to the German Democratic Republic and other countries.

* * *

NEW PROCESSES have been worked out at the Chemical and Pharmaceutical Plant in the towns of Stanke Dimitrov for the production of aluminium and magnesium gel. A new type of "Corouna" colloid mills are used in the final treatment of the preparation. A number of foreign firms have also shown interest in the new product of the Plant.

* * *

GABROVO. The Podem Plant in the town manufactures explosion-proof electric hoists designed for operation under conditions of higher fire hazards. They are of capacities up to 2 tons, and have long been in great demand on the international market.

The new electric hoists are manufactured in three different variants, depending on the height of hoisting which may be 6, 9 and 12 metres. Hoisting speed is 8 metres/min. while horizontal travel is 20 metres/min.

* * *

THE DOUNAV PLANT for mechanical and hydraulic jacks in the town of Oryahovo has initiated the manufacture of a new type of hydraulic jack to be exported to Czechoslovakia. It is designed for weights of up to 7 tons.

The manufacture is continuing for jacks to be exported to France, the Federal Republic of Germany, Denmark, Finland, to some of the countries of the Middle East, and to almost all socialist countries. Provisions have been made for a twofold increase in the manufacturing programme of the Plant this year.

* * *

A POWERFUL thyristor converter for induction heating has been designed at the Industrial Electronic Plant in the town of Gabrovo. This new item of industrial-electronic equipment bears the code name of PT-2-250 and constitutes a continuation of the series of Bulgarian-manufactured thyristor transducers for induction heating of 100 to 800 kilovolt capacities. Many foreign firms have already shown interest in these converters.

* * *

THE BULK of the output of the Telephone Equipment Plant in the town of Bansko is earmarked for export to the USSR and to the German Democratic Republic. It consists of a number of new products of the Plant – mainly telephone exchanges which are up to the latest technical requirements in this branch of technology.

* * *

CO-OPERATION has existed over a number of years now between the Plant for Telephone Equipment in the Soviet town of Perm and the Telephone Plant in Belogradchik, Bulgaria. One result of the efforts of the experts from the two enterprises is the new telephone apparatus with push-button electronic dialling, designed in a number of modifications. Dialling is very prompt, convenient and efficient, using push-button electronic elements, and without any need for storage battery. The apparatuses are attractive in form and their technical and economic parameters are high.

CSO: 2020

METHOD OF LOCAL ELECTRIC-ARC DEPOSITING OF METALS DESCRIBED

Sofia ECONOMIC NEWS OF BULGARIA in English No 6, 1978 p 1

[Article by V. Goranov]

[Text] Patents have been issued in more than 15 countries, including the USA, the Federal Republic of Germany, Britain, Switzerland and Belgium, for the original Bulgarian method of local electric-arc depositing of metals and alloys. The new method eliminates the conditions restricting the large-scale application of the normal electric-arc depositing of such material.

The qualitative and quantitative characteristics of the coatings obtained are largely influenced by variations in the speed of the revolving electrode, in its diameter, in the parameters of their planetary movement, and in the size of the current pulses.

The Elfa range of devices has been designed on the basis of the above method. It includes Series 100 for semi-conductor appliances, Series 200 – for integrated circuits, Series 300 – for reglets, Series 400 – for contact blades, and Series 500 – for various tools (with 531 as its latest representative).

Depending on their concrete use, the various types differ in their design, though at the same time they have been unified to the maximum degree, thereby providing for the interchangeability of the individual blocks, assemblies and parts. This renders servicing very easy and reduces the number of spares required by the clients.

There are new items in the above series of equipment which are at the phase of experimental models: Series 600 for depositing on tape material and Series 700 for depositing on hard-alloy lamellae.

Work is under way for linking the apparatuses to digital-programme devices and for manufacturing special automated apparatuses as per customer's requests.

The new method, which is realized through the Elfa apparatuses, makes it possible to effect substantial savings in expensive metals. Using the equipment of Series 100 leads to reducing the consumption of gold 150 times.

The apparatuses belonging to Series 500 are used on a very large scale to deposit wear-resistant hard-alloy coatings on various mechanical tools. The resultant increase in wear is the following: 3.5 times for gear-cutting tools, 4 times for thread-cutting tools, 8 to 10 times for tools used in working holes, 7.5 times for special shaping blades, 5 times for milling cutters, and 3.5 times for stamping dies.

The method may be employed to depostit material on used tools, after sharpening, and also to deposit a harder alloy than that of the particular tool, thereby allowing for an increase in its operating speed.

The annual economic effect from the use of an apparatus of the 511 (531) type, upon operation in two shifts, ranges between 200,000 and 400,000 dollars. The real effect is an over fourfold decrease in the number of tools used in normal operation.

Further details on the Elfa apparatuses, quotations included, can be obtained from the exporting establishment:

The Technika Foreign-Trade Organization
125 Lenin Blvd., Block 2
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CSO: 2020

TASKS OF AGRICULTURAL RESEARCH INSTITUTES DEFINED

Budapest MEZOGAZDASAGI ES ELELMEZESUGYI ERTESITO in Hungarian 30 Jun 78 pp 453-455

/Directive No 6/1978 (MEM. E. 14) MEM /Ministry of Agriculture and Food Industry/ by the minister of agriculture and food industry about the research tasks of research institutes, universities and colleges/

/Text/ 1. The directive's supplement contains the research tasks of research institutes defined in Point 2. and of the universities and colleges listed in Point 3. of the directive.

2. Agrargazdasagi Kutato Intezet /Research Institute of Agricultural Economics/, Budapest,

Orszagos Mezogazdasagi Fajtakiserleti Intezet /National Agricultural Type Experimentation Institute/, Budapest,

Allattenyesztesi Kutato Intezet /Research Institute for Animal Raising/, Biatorbagy (Herceghalom),

Erdeszeti Tudomanyos Intezet /Scientific Institute of Forestry/, Budapest,

Gabonatermesztesi Kutato Intezet /Research Institute of Grain Growing/, Szeged,

Haltenyesztesi Kutato Intezet /Research Institute for Fisheries/, Szarvas,

Gyumolcs- es Disznovenytermesztesi Kutato Intezet /Research Institute for Growing Fruit and Decorative Plants/, Budapest,

Kisallattenyesztesi Kutato Intezet /Research Institute for Raising Small Animals/, Godollo,

MEM Muszaki Intezet /Technical Institute of the Ministry of Agriculture and Food Industry/, Godollo,

Novenyvedelmi Kutato Intezet /Research Institute for the Protection of Plants/, Budapest,

Ontozesi Kutato Intezet /Research Institute for Irrigation/, Szarvas,

Szoleszeti es Boraszati Kutato Intezet /Research Institute for Grape Growing and Wineries/, Kecskemet,

Takarmanytermesztesi Kutato Intezet /Research Institute for Fodder Growing/, Iregszemcse,

Zoldsegtermesztesi Kutato Intezet /Research Institute for Vegetable Growing/, Kecskemet.

3. Agrartudomanyi Egyetem /University of Agricultural Sciences/, Debrecen,

Agrartudonamyi Egyetem /University of Agricultural Sciences/, Godollo,

Agrartudomanyi Egyetem /University of Agricultural Sciences/, Keszthely,

Allatorvostudomanyi Egyetem /University of Veterinarian Science/, Budapest,

Erdeszeti es Faipari Egyetem /University of Forestry and Lumber Industry/, Sopron,

Kerteszeti Egyetem /University of Horticulture/, Budapest,

Elelmiszeripari Foiskola /Food Industry College/, Szeged,

Mezogazdasagi Foiskola /Agricultural College/, Kaposvar.

4. The research institutes conduct their business according to the banking account budgetary system.

5. This directive becomes effective on the day it is published. Simultaneously, No. 29/1970 (MEM. E. 37) MEM, No. 24/1974 (MEM. E. 44) MEM, No. 1/1976 (MEM. E. 7) MEM and No. 15/1976 (MEM. E. 12) MEM directives are superseded.

/signed/ Jeno Vancsa, Deputy Minister

Supplement to Directive No 6/1978 (MEM. E. 14) MEM.

Research Tasks of the Research institutes and of the Universities and Colleges

Agrargazdasagi Kutato Intezet /Research Institute of Agricultural Economics/, Budapest

Discovery and complex research of the economic laws prevailing in agriculture.

Research of ways and means serving the economic regulation of agriculture, drawing of conclusions and working out proposals for economic policy decisions, investigation of the situation and significance of agriculture and the food industry in the people's economy, working out methods and prognoses for the planning of growth.

Complex economic study of the branch including the vertical and horizontal levels, the people's economy and plant management, laying down scientific foundations in the producer cooperatives and within the state farms for improving operations.

Realization of the most advanced plant and work organizing procedures in practice, coordination of the organizing activity under way in agriculture, organizational service and evaluation of the practical applicability of the results achieved by organization science.

To perform the latter tasks, the institute operates an independently funded department named Agraripari Szervezesi Szolgalat /Organizing Service of the Agricultural Industry/.

Orszagos Mezogazdasagi Fajtakiserleti Intezet /National Agricultural Type Experimentation Institute/

Its task is to organize type experiments and type tests and to evaluate the results, to make proposals for national qualification and for determining the breeding and economic values of animal types. Its task is to further develop type-research methodology, to maintain and professionally direct type-experiment stations.

It is also its task to import the extender materials needed for type-comparison experiments, to aid in the distribution of new types, to collect, save, document domestic and foreign plant types, to organize their exchange, to perform evaluating investigations on the collected material. Cooperation in type improvement by making available the base materials for type improvement and following type-maintenance activity with attention. Collecting and evaluation study of plant types grown by man and those living in the wild and of the various varieties of these, passing them on as type-improvement base materials and preserving them as gene reserves.

Erdeszeti Tudomanyos Intezet /Scientific Institute of Forestry/, Budapest

Its task is complex research directed at developing systems theory in forestry management (ecology, type improvement, forest renewal and planting, forestry operations, arboriculture study, defense against fungus infections and damaging insects which cause damage in the forest, technological development, aenonomics /sic/.

It coordinates research and development tasks directed at plant and work organization in forestry management and in the primary lumber industry.

It conducts scientific study of the forest's environmental protection, social and vacationing roles, cooperates in establishing and maintaining a forestry gene bank.

Coordinates the environmental protection and gene bank research projects agriculture and of the food industry branch.

Gabonatermesztesi Kutato Intezet /Research Institute of Grain Growing/, Szeged

Its task is type improvement of bread grains (autumn wheat, spring wheat, rye) and of fodder grains (autumn barley, spring barley, brewing barley, autumn oat, spring oat, triticale /a wheat-rye cross/, corn, fodder sorghum/broom sorghum, oil flax, sunflower and rape), and the modernization of growing these.

Haltenyesztesi Kutato Intezet /Research Institute for Fisheries/, Szarvas

Its task is to perform the research tasks related to increasing the quantity and improving the quality of fishmeat production.

Gyumolcs- es Disznovenytermesztesi Kutato Intezet /Research Institute for Growing Fruit and Decorative Plants/, Budapest

Its task is to do type improvement work on fruit-bearing plants, do type improvement work on roses and annual flowers and to modernize the growing of these.

Kisallattenyesztesi Kutato Intezet /Research Institute for Raising Small Animals/, Godollo

Its task is research directed at improving the raising of small animals and at improving the raising of bees and of honey production.

MEM Muszaki Intezet /Technical Institute of the Ministry of Agriculture and Food Industry/, Godollo

Its task is to conduct research and experiments directed at developing agricultural machinery systems, at improving the mechanization technology of the producing branches, at improving the organization of work done by machinery, of machinery operation and of plant maintenance; conducting technical and economic studies, working out prognoses directed at improving the complex mechanization of agriculture over the long run; conducting labor and health protection research, working out study procedures related to machinery and equipment; trying out new machinery, supervisory investigation of equipment and establishments, working out the supplements necessary for their operation, aid in the introduction of new plant procedures.

Novenyvedelmi Kutato Intezet /Research Institute for the Protection of Plants/, Budapest

Its task is to conduct basic research related to the biology of the causers of damage and causers of illness to plants and of weeds, to improve the methods of defense against the damage causers.

Ontozesi Kutato Intezet /Research Institute for Irrigation/, Szarvas

Its task is to research the biological, production, technical and economic foundations of production using irrigation, to improve pasture and meadow management, type improvement of lawn plants and of rice, and improvement of their production.

Szoleszeti es Boraszati Kutato Intezet /Research Institute for Grape Growing and Wineries/, Kecskemet

Its task is to improve grape types and to improve the growing of these, to work out the modern methods of grape processing and of the handling of wine.

Takarmanytermesztesi Kutato Intezet /Research Institute for Fodder Growing/, Iregszemcse

Its task is to work out modern fodder-producing systems and the complex research directed at their improvement, and type improvement of oil containing plants, soya and fodder peas.

Zoldsegtermesztesi Kutato Intezet /Research Institute for Vegetable Growing/, Kecskemet

Its task is to do type improvement on vegetables and to improve the growing of these.

Allattenyesztesi Kutato Intezet /Research Institute for Animal Raising/, Biatorbagy (Herceghalom)

Its task is to conduct research to lay the foundations for raising animals, research directed at raising milk cows and coordinating this, research directed at improving hog and horse raising.

Agrartudomanyi Egyetem /University of Agricultural Sciences/, Debrecen

Its range of tasks is to perform complex research directed at improving the soil's management of nutritional materials and water, conduct improvement research projects, research directed at improving the tilling of the soil and the development of the soil, economic evaluation of the technical development of agricultural enterprises, and to conduct research work directed at increasing the production of goose meat.

University of Agricultural Sciences, Godollo

Its task is complex research directed at developing the biological, technical and economic foundations of agricultural production, type improvement of perennial fibrous fodder plants and fiber plants for the plowfields, research in the improvement of growing these, in the methods of soil protection-management, and further, research in wildlife mamagement, as well as conducting research directed at increasing the production of goose liver.

University of Agricultural Sciences, Keszthely

Its task is type improvement of potatoes, and research directed at improving soil-potency management and fodder management, and at modernizing the management of enterprises.

Allatorvostudomanyi Egyetem /University of Veterinarian Science/, Budapest

Its task is research directed at working out the optimal animal health care conditions of animal health care (veterinary activity) and of food production of animal origin.

Kerteszeti Egyetem /University of Horticulture/, Budapest

Its task is to examine the biological, chemical, technological and economic factors or horticultural production and product preservation.

Erdeszeti es Faipari Egyetem /University of Forestry and Lumber Industry/, Sopron

Its task is research in the basic questions of forestry, lumber industry and wildlife management.

Elelmiszeripari Foiskola /Food Industry College/, Szeged

Its task is research directed at processing animal products (in the meat industry, dairy industry, and also in the fodder industry).

Mezogazdasagi Foiskola /Agricultural College/, Kaposvar

Its task is research directed at beef cattle raising and at improving the raising of pigeons.

8584
CSO: 2502

DISEASE RESISTANCE OF RATED WHEATS GROWN IN HUNGARY

Budapest MAGYAR MEZOGAZDASAG in Hungarian No 21, 25 May 78 pp 6-7

[Article by Mrs Istvan Manninger, Dr; Dr Laszlo Balla; Mrs Laszlo Szunics, Dr; and Dr Laszlo Szunics, Agricultural Research Institute of the MTA [Hungarian Academy of Sciences], Martonvasar]

[Text] Dependable yield of wheat depends primarily on the resistance of the types grown and on their tolerance. Measures involving the use of chemicals help; however, insofar as wheat is concerned, we know economical methods against blight only. The growing of resistant types would provide protection against other diseases.

Diseases of Wheat

Until the mid-1960's we thought that the most dangerous diseases of wheat are steam and leaf blight. Then, with the introduction of intensive agricultural technology, the conditions became more favorable for the occurrence of powdery mildew. This latter disease became prevalent during the past decade. Simultaneously with the emergence of powdery mildew, certain stem-base diseases (Ophiobolus graminis, Fusarium ssp., Cercosporella herpotrichoides, and so forth) also caused major damage in certain years. During the last two years we also encountered septorial leaf and stem infections, as well as yellow rust.

The greatest problem insofar as agricultural production is concerned is the fact that the disease-resistant types have relatively short lifetimes. It is for this reason that the Kavkaz and Aurora types, which have high yield and are resistant to powdery mildew and leaf blight, deteriorated in so spectacular a manner in the recent past. Today we all know that the deterioration of these types is the joint result of several different factors.

We now have more and more of the new biotypes of the No 77 leaf blight strain (which, according to studies of Mrs Bocsa, account for 99.6 percent of the leaf-blight strains). In addition, powdery mildew types viable in the presence of these types of blight emerged and spread on the Kavkaz and Aurora wheat (No 2, 4, 9, 26, and 52). In our experience, the steam-base diseases damage the above-mentioned wheat types more seriously than they did during the first two years following their introduction. It is also possible that their adaptability is not as good as would be desired. As a result of their longer growing time, they withstand draught less well than the earlier types.

Another example for the stopping of the resistance is the Szava type, which presently accounts for approximately 10 percent of the wheat acreage. This type was practically fully resistant to powdery mildew until 1976 but in 1977 was already found to be receptive (see the tabulation). We could give additional examples from our own experience.

The presently used agricultural technologies favor not only the wheat but also the disease-causing agents. Obviously, our task for the future must be to develop adequate resistance in the new wheat types and to try and retain this resistance.

Weather Effects

We all know that the weather has also an effect on the deterioration of the wheat through diseases, in addition to the type being grown, and the spectrum of disease-causing agents present. Thus, we examined the precipitation and temperature conditions, as well as the hours of sunshine during the years 1975, 1976, and 1977, based on data for Martonvasar. The study covered the March to July period, which is the decisive period insofar as the development of the diseases is concerned. The data show that the precipitation was higher by 70 mm than the average of many years in 1975 (in 1976 it was 111 lower and in 1977 it was 15 mm lower). At the same time, the temperature was close to average. The sum of the deviations from the average of the five months studied was +5.8°C for 1975, +3.5°C for 1976, and +5.0°C for 1977. The amount of sunshine was below average over the entire study period: 263 hours less in 1975; 89 hours less in 1976; and 201 hours less in 1977. The relative atmospheric humidity and the dew conditions also affect significantly the situation, among the weather factors.

In our opinion, the last few years favored the proliferation of the diseases since the weather was wet, hot, and low in sunshine. The greatest losses were encountered in 1975, where the crop yield decreased as a result of powdery mildew on the leafs and stems, septorial and fusarial disease on the stem, and stem-base diseases (steam-base fungus and stubble fungus). The year 1976 did not favor the so-called "humid-weather" diseases; however, there was much powdery mildew and stem-base blight disease. In the year 1977, there was more than average of powdery mildew, stem blight, and stubble fungus, but not to the same degree as in 1975. In the year 1977, many heads broke as a result of thunderstorms and heavy rains during the early period.

The Yellow Blight Emerges

Yellow blight was not regarded as a dangerous wheat disease in Hungary before since it was encountered only if the spring was wet and cold. But it was observed in many places during 1977. Since the majority of the wheat types grown resisted this disease, there was no major loss. The yellow blight afflicted practically only the Rana 1, Rana 2, Rana 3, and Szava types. But it became evident that receptive types can be damaged by yellow blight, and that this disease can be encountered in Hungary too.

Last year the damages were above-average in Romania, Slovakia, and Bulgaria too. For the first time in many years, first occurrences and major infestations were reported from Yugoslavia and Italy, respectively.

The various wheat types grown in Hungary differ significantly in terms of resistance and tolerance. The growing period also affects the magnitude of any damage. For example, the early types precede the blight infestation and thus are pseudo-resistant. The tabulation provides specifics about the individual types.

In general, the types have a satisfactory resistance against leaf blight. High damage is encountered only if there is a major leaf-blight epidemy. But we must be cautious since the Jubilejnaja 50 type — which is most receptive to leaf blight — is grown over relatively large acreage.

Most of the types grown have a less than desirable resistance against stem blight. Thus, in years favoring this disease, we may expect epidemic infestation. Some types have adequate resistance; others are of the early type so that they suffer no major damage. Still, we must emphasize measures aimed at increasing the resistance to stem blight.

None of the types is resistant to powdery mildew. However, the more recent types are more resistant that the earlier types, so that there is some improvement to report.

Among the types considered for approval by the state, the approval tests indicate several which are more resistant to the major dieases than the currently approved types (see the tabulation). If they turn out to be satisfactory in all respects, and are ultimately approved, we will have more and better types of wheet to choose from.

Fajták (1)	Liszt-harmat (2) 1975	Levél-rozsda* (3) 1975	Szár-rozsda* (4) 1975	Liszt-harmat (2) 1976	Levél-rozsda* (3) 1976	Szár-rozsda* (4) 1976	Liszt-harmat (2) 1977	Levél-rozsda* (3) 1977	Szár-rozsda* (4) 1977
Bezosztaja 1	4	3	4; 3	4	2	3	4	3; 4	3; 2
Martonvásári 4	3	3; 4	4	3	3	3	4	4; 3	3; 2
Martonvásári 5	3	3	4; 3	3	3	3; 4	3	4; 3	3; 4
Partizanka	4	—	—	5	—	—	3	1; 2; 3	3; 2
Kompolti 1	4	3; 4	4	3	3	3	4	4; 3	3; 4
Martonvásári 6	3	3; 4	4; 3	3–4	3	4; 3	3	4; 3	4; 3
GK-3	3	2; 3	4	3	2	4; 3	4	3; 2	4
GK Fertődi 2	—	—	—	3	2	4; 3	3	3; 2	4
Jubilejnaja 50	3	4	4	4	3	4; 3	4	4; 3	4; 3
Száva	2	1; 2	4	2	2; 1	4; 3	3	2; 1	4
Martonvásári 1	3	3; 4	4	4	3	4	3	4	4
Libellula	2	2; 3	4	2	2	4	2	2; 3	4
NS Rana 1	—	—	—	0	2	4	2	2; 1	4
NS Rana 2	—	—	—	0	2; 3	4	2	2	4
NS Rana 3	—	—	—	—	—	—	2	2	4
Rivoli	—	—	—	—	—	—	2	3; 2	4
Fajtajelöltek (5)									
Mv 06–75	4	3; 4	4	4	3; 4	4; 3	4	4;3	4; 3
Mv 11–75	3	3; 4	3; 4	3–4	3	3	3	4; 3	3; 2
Mv 103	—	—	—	3	4; 3	3; 2	—	—	—
Mv 05–77	4	3; 4	4	5	3; 2	3	4	4	3; 2
Mv 06–77	1	2; 1	4; 3	1	1; 2; 3	3; 4	2	2; 3	4; 3
Mv 07–77	1	3	2	3–4	3; 2; 4	1; 2	4	2; 3; 4	1; 2; 3
Mv 18–77	1	2; 3	1; 3	3	2; 1	1	2	2; 3	1; 3
Mv 22–77	4	—	—	2	3; 4; 2	3	3	4	3
Mv 23–77	4	—	—	2	4; 3; 2	3	3	4	3; 4
Bezosztaja 1	4	3	4; 3	4	2	3	4	3; 4	3; 2

Jelmagyarázat: * = provokációs kísérlet
0 = nagyon ellenálló, 1 = ellenálló, 2 = közepesen ellenálló,
3 = közepesen fogékony, 4 = fogékony, 5 = nagyon fogékony

Megjegyzés: Több szám előfordulásakor (pl. 3; 2) az esetek többségében az első szám a jellemzőbb.

Powdery-mildew and blight infestation of approved autumn wheat types and autumn wheat types considered for approval, based on field tests (Martonvasar, 1975-1977) [Key on next page]

[Key for table on preceding page]

1. Types
2. Powdery mildew
3. Leaf blight
4. Stem blight
5. Types considered for approval

*	Provocational test
0	Highly resistant
1	Resistant
2	Medium resistant
3	Medium receptive
4	Receptive
5	Highly receptive

Note: If several numbers are given (for example, 3; 2), the first number given is more typical.

2542
CSO: 2502

POLAND

SATELLITE-RANGING LASER SYSTEM DESCRIBED

Warsaw ZOLNIERZ WOLNOSCI in Polish 30 Jun 78 p 3

[Article by Col Dr Eng Zdsislaw Jankiowicz of the Military Technical Academy: "The Laser and Satellites"]

[Text] For us, with each passing day, space tasks are becoming ever more common. We continue to learn without interruption of new scientific successes in the conquest and use of outer space. Among the equipment which has been used for over 10 years in these investigations are satellite-ranging lasers. Such a first-generation rangefinder is operating in Poland at the Polish Academy of Sciences' observatory in Borowiec, near Poznan. Presently we are installing so-called second-generation rangefinders, and already there is talk of a third generation. Each generation brings about more precise lasers which enable increasingly more accurate measurements.

First-generation laser rangefinders were designed to measure distances to artificial earth satellites orbiting at distances of a little more than 1,000 km. The accuracy of these measurements was expressed in meters. Presently it is necessary to measure satellite distances of 10,000 to 20,000 km with decimeter accuracies.

Satellite-ranging laser measurements are used to determine orbit parameters, and thus the flight conditions of the satellite itself. Data obtained via this method are used also for lithosphere measurements and changes within the lithosphere.

Before I proceed to discuss the construction of a second-generation ranging laser, however, I will attempt in a few sentences to explain its principle of operation.

Laser rangefinders operate in a manner similar to that of ordinary radar. In the case of a laser, it is a pulse of light that is emitted from a pulse transmitter which impinges on a target, the object of the measurement. At the receiving point (usually the same as the transmitting point), we receive the echo signal, the so-called energy reflected from the object being measured. Because the velocity of light in space is known, the time lapse between the time the pulse is transmitted and the time the echo is received is a measure of this distance.

It is relatively simple to measure this time lapse. To do this, it is only necessary to count, with the aid of an electronic counter, the number of pulses generated by an accurate generator, a so-called quartz clock, during the time interval between light pulse transmission and reception. The number of counted pulses is directly proportional to the elapsed time, and the counter can be calibrated directly in units of distance.

Often the question is asked: Why are lasers actually used for this purpose? To understand why, one must comprehend the size of a satellite, its distance from the Earth's surface, as well as required measurement accuracies. Only laser transmitters can provide beam parameters that permit distance measurements to such small objects orbiting at great distances (today there is even talk of distances in excess of 35,000 km) with accuracies of about 12 centimeters or even several centimeters. But even with the aid of lasers, at these distances one can "locate" only special satellites that are adapted for this purpose, that is, satellites equipped with light reflectors that increase the efficiency of reflection.

At the present stage of laser technology we can produce laser pulses of unusually short duration, on the order of nanoseconds (billionths of a second) and even picoseconds--depending on the pulse-shortening technique used. Such a pulse is actually a wave packet which occupies about 12 centimeters in space. This permits highly accurate measurements.

In addition, lasers enable precise beam collimation. The angle at which the pulse is transmitted is in fractions of a milliradian (about one-hundreth of a degree). Despite this, to receive a signal reflected from such a distant object, the wave packet must contain a relatively large amount of energy. And lasers actually make this possible. Special generating and amplifying systems permit the generation of light pulses having peak powers in the gigawatt range (billions of watts) and even higher.

The construction of a complete rangefinder system is based on its operation. Of course, the most important component is the laser transmitter. In addition to the above-mentioned characteristics, the transmitter must transmit pulses relatively frequently. A satellite is in constant motion, and its orbit parameters should be measured at various points in its orbit during the time the satellite is in a station's field of view. This presents no basic difficulty, because modern rangefinders use a yttrium-aluminum garnet alloyed with neodymium as the active material instead of a ruby. These lasers, even those that are pulse activated, can generate up to 100 pulses per second. Such a frequency is quite satisfactory when evaluating orbit parameters.

Unfortunately, lasers generate a wave in the nonvisible spectrum having a wavelength of 1.06 micrometers, for which the sensitivity of light receivers is insufficient. The solution to this problem is the use of known techniques to multiply the frequencies of light waves. With the aid of nonlinear crystals, a generated frequency can be transformed into its second harmonic.

For a neodymium laser, a frequency whose wavelength is 0.53 micrometer is obtained after transformation. This is green light, which transmits well in space and for which there are detectors that are very sensitive.

It should also be mentioned that the transmitter is a multistage transmitter. It consists of a generator, pulse-shaping circuits and amplifiers. There are many of them. Their active materials consist of rods of increasing diameters made of yttrium-aluminum alloyed with enodymium ions. The generated pulses are amplified in them to the desired level. Now all that is needed is to transform this radiation into its second harmonic and to direct the light pulses toward the object in orbit via an optical transmitting system.

A very important satellite rangefinder component is the receiver, which also includes an optical receiving system. The receiver mirror must be at least 50 cm in diameter in order to direct as many reflected photons as possible to the detector. There are few photons--barely a few--several dozen or so or up to 100, depending on measuring conditions. This make it necessary to use a very sensitive light receiver. Multiplier phototubes are used here; these are precooled to the temperature of liquid nitrogen (-196^{o}C) in order to reduce internal noise.

In addition, it is possible to receive false signals generated by other light sources such as the Sun, stars and Moon. Not wanting to get involved in intricate technical problems, I will only mention simplest ways of reducing the probability of receiving false signals. Above all, the receiver is open only during the short period of time when we expect the return of the pulse echo. The orbit distance and the moment at which the reflected pulse is to be received are known approximately. Gating the receiver significantly decreases the possibility of noise occurring. In addition, the receiver input is covered with a narrow-band filter which transmits light within the narrow frequency band transmitted by the receiver. Without the above-mentioned provisions, in general it would be impossible to receive such low-level signals.

The transmitter and receiver telescopes are located on a stand which must be capable of appropriate angular motions in order to track the satellite's flight. Drive systems for these stands are usually controlled by computers to which orbit data are fed. This enables the telescope to keep pace with the tracked object. Visual observation and even manual control are also possible when a satellite is illuminated with sunlight. Thus, additional observation telescopes are located on the stand for this purpose. Of course, this holds good only for specific observation hours--shortly after sunset and before sunrise.

To complete the picture, I wish to add that the very impingement of the laser beam on the satellite presents a problem in itself. To make repetitive contact with the satellite with the beam (restricted to an angle that is a fraction of a milliradian) requires unusual precision in building the stand

as well as in controlling its motion. For this reason, the laser and the base on which it is mounted must be at a temperature that is very stabilized.

As indicated above, despite the simple operating principle of a laser, locating an artificial earth satellite is an unusually complicated problem. It should be emphasized that to resolve this problem a laser, as well as other rangefinding equipment, must be built to the most exacting world standards.

11899
CSO: 2602

BRIEFS

NEW MINICOMPUTER--In the enterprise for electronic computation in Bucharest, series production has begun on a new Romanian minicomputer, the Felix MC-8, the result of collaboration between specialists of the Polytechnical Institute in Bucharest and the producing units. The system of computation of the new device was designed and achieved by taking into account the latest technologies used in the world. The minicomputer is used in the direction and supervision of industrial processes, in economic management, in medicine, as well as in scientific research and education units. As a result of the use of integrated circuits for the microprocessor and memory, it has a high level of reliability in operation. [Text] [Bucharest ROMANIA LIBERA in Romanian 11 Jul 78 p 3]

CSO: 2700

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